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## Hellenic Journal of Cardiology

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## Correspondence

## Excess mortality in Greece during 2020: the role of COVID-19 and cardiovascular disease



Coronavirus Disease (COVID-19), whose outbreak started in late December 2019 in China, constitutes a considerable public health problem worldwide. According to the World Health Organization, over 83.5 million infected cases and approximately 1.8 million deaths (Case Fatality Rate, 2.2%) occurred during 2020, while over 20.5 million years of life have been lost so far<sup>1</sup>; particularly in the European Union, during 2020, the cumulative number of cases reached 16 million with 370,650 deaths (Case Fatality Rate, 2.4%). In Greece, COVID-19 appeared on February 26, 2020 and caused 138,850 infected cases and 4,838 deaths during 2020 (Case Fatality Rate, 3.4%), according to the data provided by the National Public Health Organization.

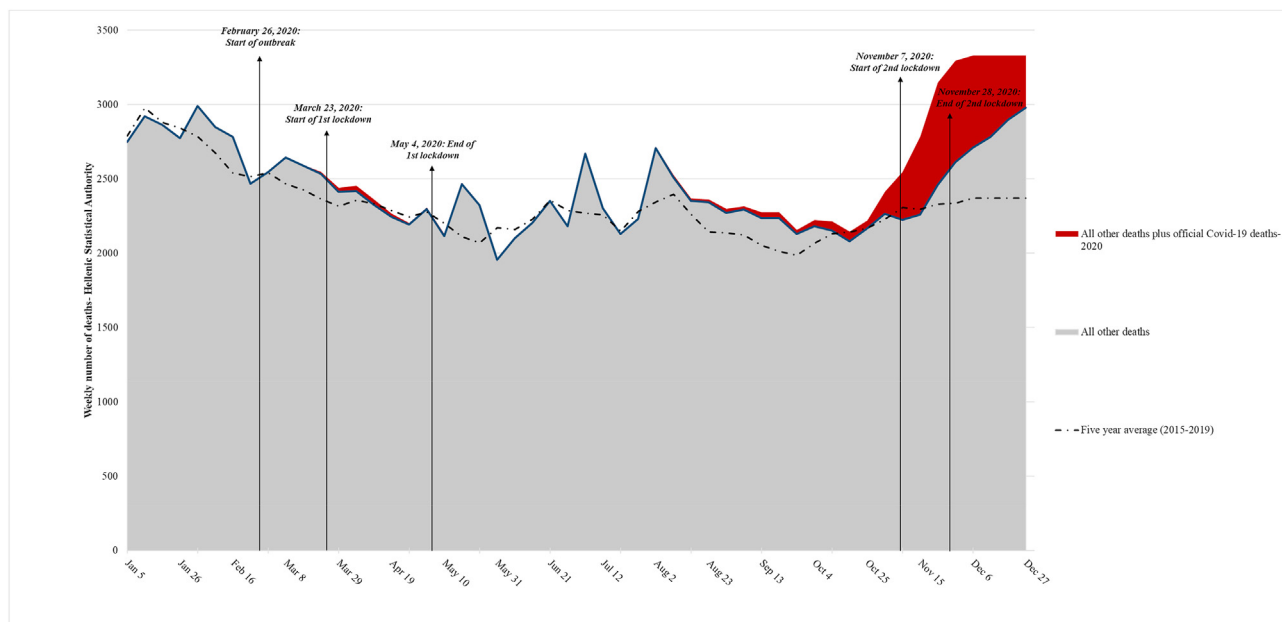
Mortality comprises one of the most significant indicators of a population's health status, while the excess mortality, which is defined as the increase of all-cause mortality over its historic average (usually the preceding 5–10 years), forms the “gold standard” method being used globally for the estimation of an epidemic impact on the population's health.<sup>2</sup> During 2020 (ISO week 52) and according to the data provided by the Hellenic Statistical Authority (ELSTAT), 130,288 deaths from all causes had been recorded in Greece.<sup>3</sup> This is equivalent to 355 deaths per day. Compared to the average of the previous 5 years (2015–2019), the mortality rate in 2020 increased by 6.7% (i.e., excess mortality), whereas a 4.6% increase was also observed when compared with the previous year, 2019. Moreover, deaths from COVID-19 were 4,838, which comprises 3.7% of total deaths in Greece during 2020 (Fig. 1).

According to the report of the European Statistical Authority (EUROSTAT), COVID-19-specific mortality presented a considerable rise during March 2020, with a total of approximately 297,500 excess mortality that occurred in the European Union between March and October 2020 when compared with the same period in 2016–2019.<sup>2</sup> In Greece, as compared to several other countries such as the USA, France, Spain, Italy, and the UK where a significantly excess mortality was observed reaching up to even the 156% in Spain during the Spring of 2020, the share of deaths from COVID-19 until September 2020 was negligible. However, in November 2020, when the number of COVID-19-specific deaths tripled as compared to September 2020, the all-cause excess mortality exceeded even 30% (Fig. 2), which was approximately 116 times higher than that of Norway, where population's compliance with infection preventive measures was even higher than 98%.<sup>4</sup>

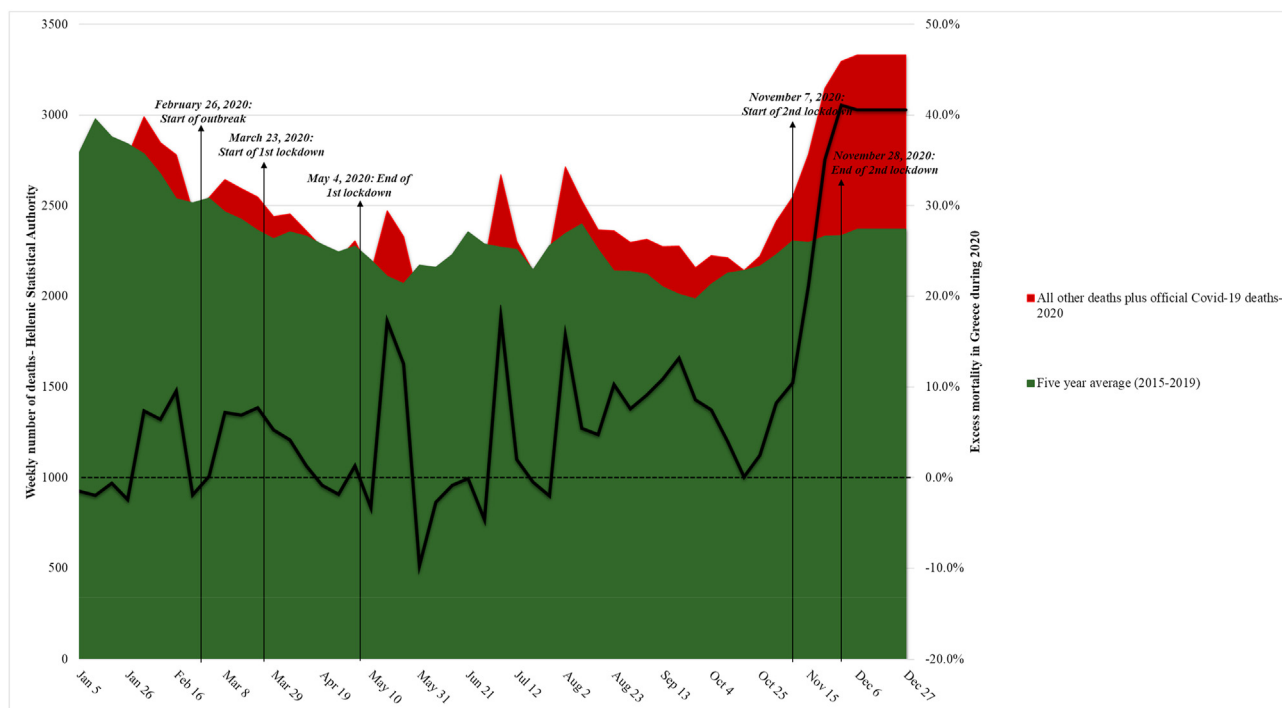
Despite the fact that the increment of the excess mortality in Greece can largely coincide with the COVID-19 outbreak, it cannot be fully attributed to it, as similar increases have occurred in previous years, mainly due to the aging of the population, the adoption of unhealthier lifestyles, and the increased prevalence of newer risk factors.<sup>5</sup>

Cardiovascular diseases (CVD) are the leading cause of death in Greece since the 1970s. According to national statistics, 37% of deaths in Greece during 2019 were attributed to CVD, followed by various types of cancer (26%) and respiratory infections (12%).<sup>3</sup> Based on the ATTICA epidemiological study, the 10-year fatal or nonfatal incidence of CVD was 1,570 new cases per 10,000 individuals, while the causes of deaths were: 51.1% due to CVD, 30.0% due to neoplasms, 7.8% were due to infections (mainly pulmonary), and the remainder 11.1% were due to various other reasons.<sup>6</sup> Moreover, in a systematic analysis of the Global Burden of Disease Study 2019, for Greece, ischemic heart disease had a 11.8% increase in mortality between 2009 and 2019, whereas stroke had a 20.3% increase.<sup>7</sup>

Even though the excess mortality for 2020 in Greece is a fact, it should be noted that it is much lower than that of other European countries. This excess mortality is mainly attributed to the epidemic of COVID-19, which was observed during the autumn outbreak and despite the restrictive measures that were in force for the entire population. Nevertheless, CVD remains the main cause of death and disability in Greece, accounting for one-third of deaths annually. As noted by Tousoulis D., “the residual cardiovascular risk that remains unexplained is considerable. Research on novel risk factors as a sole feature or as part of a cumulative condition may provide clues to the mechanism underlying CVD events”.<sup>5</sup> Lockdown itself or changes in the organization of the health system may also have an impact on the excess mortality beyond COVID-19. It has also been reported that individuals with heart symptoms may have not asked for medical care because of the fear of infection. In addition, infarct-related symptoms such as chest pain, discomfort, or dyspnea could have been misinterpreted as being related to an acute respiratory infection. Viral infections, including COVID-19, may also play a role in increasing the burden of CVD in the future.<sup>8–10</sup> Without a doubt, it is expected that cardiologists will be asked to handle much more complicated situations in clinical practice, calling for more evidence from laboratory and clinical research.



**Figure 1.** Weekly number of deaths in Greece for the period between January and December 2020 (ISO weeks 1–52).



**Figure 2.** Excess mortality in Greece for the period between January and December 2020 (ISO weeks 1–52).

## References

- Pifarré I Arolas H, Acosta E, López-Casasnovas G, et al. Years of life lost to COVID-19 in 81 countries. *Sci Rep.* 2021;11(1):3504.
- EUROSTAT 2020. Accessed at <https://ec.europa.eu/eurostat/statistics-explained> on 24 February 2021.
- Hellenic Statistical Authority (ELSTAT). Accessed at <https://www.statistics.gr/en/statistics/-/publication/SPO09/-> on March 2020.
- Kontis V, Bennett JE, Rashid T, et al. Magnitude, demographics and dynamics of the effect of the first wave of the COVID-19 pandemic on all-cause mortality in 21 industrialized countries. *Nat Med.* 2020;26(12):1919–1925.
- Tousoulis D. Novel risk factors in coronary artery disease: are they clinically relevant? *Hellenic J Cardiol.* 2019;60(3):149–151.
- Panagiotakos DB, Georgousopoulou EN, Pitsavos C, et al, ATTICA Study group. Ten-year (2002–2012) cardiovascular disease incidence and all-cause mortality, in urban Greek population: the ATTICA Study. *Int J Cardiol.* 2015 Feb 1;180:178–184.
- GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis

- for the Global Burden of Disease Study 2019. *Lancet*. 2020;396(10258):1204–1222.
8. Guo J, Huang Z, Lin L, Lv J. Coronavirus Disease 2019 (COVID-19) and Cardiovascular Disease: A Viewpoint on the Potential Influence of Angiotensin-Converting Enzyme Inhibitors/Angiotensin Receptor Blockers on Onset and Severity of Severe Acute Respiratory Syndrome Coronavirus 2 Infection. *J Am Heart Assoc*. 2020;9(7), e016219.
  9. Triposkiadis F, Boudoulas KD, Xanthopoulos A, Boudoulas H. Fallacies in medical practice: Renin-angiotensin-aldosterone system inhibition and COVID-19 as a Paradigm. *Hellenic J Cardiol*. 2020 Nov 11;S1109–9666(20), 30249-9.
  10. Lazaridis C, Vlachogiannis NI, Bakogiannis C, et al. Involvement of cardiovascular system as the critical point in coronavirus disease 2019 (COVID-19) prognosis and recovery. *Hellenic J Cardiol*. 2020 Jun 10;S1109-9666(20), 30093-2.

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